

Assessing the Effectiveness of Environmental Risk Communication in Response to Natural Disasters of 2025

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Abstract

This article examines the perceived effectiveness of environmental risk communication during natural disasters in Pakistan in 2025. Drawing on survey responses from 316 adults, the study evaluates how disaster-related information exposure, trust in information sources, perceived barriers, cultural relevance, and protective behaviour shape public responses. The findings indicate that respondents generally viewed risk communication as moderate rather than highly effective. Social media emerged as an important information channel, while local community leaders were perceived as comparatively trusted sources. Correlation results showed that communication exposure, trust, and awareness of barriers were associated with protective behaviour, although exposure alone was not sufficient to ensure immediate action. The study concludes that disaster communication in Pakistan should move beyond simple warning dissemination toward a people-centred model based on credible sources, locally understandable messages, multiple channels, and practical guidance that helps citizens act before and during disasters.

Keywords: Environmental Risk Communication; Natural Disasters; Pakistan; Protective Behavior; Trust; Social Media; Disaster Communication.

Introduction

Pakistan frequently faces environmental hazards, including floods, flash floods, heatwaves, landslides, earthquakes, and droughts, as well as related climate-sensitive emergencies. These hazards become more damaging when they affect communities with limited infrastructure, weak preparedness, poverty, low literacy, restricted mobility, and unequal access to timely information. In such situations, disaster management is not only a technical or administrative process; it also depends on whether people receive warnings in time, understand the message, trust the source, and know what practical steps they should take.

Environmental risk communication plays a central role in connecting official warnings with public action. During disasters, people often make urgent decisions about evacuation, shelter, health precautions, family safety, and protection of property. A warning that is scientifically accurate may still fail if it is too late, too technical, poorly localised, or delivered through channels that people do not use. Therefore, effective communication must be clear, timely, credible, culturally understandable, and action-oriented. This is especially important in Pakistan, where communities differ in language, education, media use, digital access, institutional trust, and capacity to respond.

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The 2025 disaster context makes this issue particularly important. Pakistan continued to experience seasonal hazards, including monsoon-related flooding, urban flooding, flash floods, heatwaves, and other environmental risks. These events required coordinated messages from disaster management authorities, media organisations, local leadership, social media sources, and community networks. However, multiple channels can also create confusion when messages are inconsistent or when rumours spread faster than verified warnings.

This article is extracted from a thesis that assessed public perceptions of environmental risk communication in response to natural disasters of 2025. The main purpose is to identify how respondents perceived communication effectiveness, which sources they trusted, what barriers limited action, and how communication exposure was associated with protective behaviour. The article focuses on the most important variables, questionnaire-based findings, and statistical relationships so that the thesis can be presented in a concise, publishable format.

Literature Review

The literature on disaster and environmental risk communication emphasises that warnings are effective only when they move from information delivery to public understanding and action. Global disaster frameworks such as the Sendai Framework highlight people-centred early warning and preparedness, while risk communication scholarship stresses transparency, timeliness, credibility, empathy, and practical instruction (UNDRR, 2015; Reynolds & Seeger, 2005; WHO, 2017). In disaster conditions, people do not respond only to the presence of information. They evaluate the seriousness of the threat, the reliability of the source, the clarity of the guidance, and whether they have the means to act.

Research also shows that communication channels matter. Traditional media such as television and radio remain useful for broad public alerts, especially among audiences with limited internet access. At the same time, digital media and social platforms have become powerful sources of real-time updates, peer-to-peer sharing, and rapid dissemination of warnings. However, digital platforms can also spread misinformation, unverified claims, and conflicting instructions. For this reason, disaster communication should use a multi-channel strategy in which official alerts, social media, mobile messages, traditional media, and local community networks support one another rather than compete.

The literature further identifies trust, cultural relevance, and practical barriers as central variables. People are more likely to follow disaster guidance when they believe the source is competent, honest, and concerned about public safety. In Pakistan, local leaders, religious figures, elders, teachers, volunteers, and community organisations may strengthen message acceptance because they are socially close to the audience. At the same time, even trusted information may not produce protective action if citizens face constraints such as a lack of transport, financial limitations, unclear instructions, language barriers, fear of property loss, or limited access to safe shelters.

Theoretical Framework

Two theories were used to explain why people respond differently to disaster communication: the Situational Theory of Publics and Framing Theory. Together, these theories connect audience behavior with message design. The first theory explains public attention and action; the second explains how the presentation of the message shapes interpretation.

Situational Theory of Publics

The Situational Theory of Publics argues that people become active or passive depending on how they recognize a problem, how personally involved they feel, and how many constraints they perceive (Grunig, 1997). In this study, the theory helps explain why some respondents may receive disaster information but still delay action. A person may understand that a flood or heatwave is dangerous, but if they believe they lack transport, shelter, money, or family permission, they may not act immediately. The theory is relevant because it links communication effectiveness with problem recognition, involvement, and perceived barriers.

Framing Theory

Framing Theory explains how the way a message is presented can influence how people understand a situation and decide what to do (Entman, 1993). In disaster communication, a message can be framed as an urgent warning, a safety instruction, a community responsibility, or a reassurance message. This framing affects whether people see the hazard as serious, manageable, exaggerated, or personally relevant. In the Pakistani context, framing is important because messages must be simple, culturally understandable, and connected to practical steps. A warning that only announces danger may create anxiety, while a warning that explains who is at risk, where to go, and what to carry is more likely to support protective action.

Relevance of the Theories to the Research

These theories are relevant because the study is not limited to whether warnings were issued. It examines whether people noticed the communication, trusted it, understood it, felt personally concerned, faced barriers, and adopted protective behavior. The Situational Theory of Publics explains differences in audience readiness, while Framing Theory explains how message clarity, cultural fit, and action-oriented wording may improve public response. Together, they provide a useful framework for interpreting exposure, trust, barriers, and protective behavior.

Methodology

The study used a quantitative, cross-sectional survey design. This design was suitable because the research aimed to measure public perceptions and examine relationships among key variables at a specific point connected with the 2025 disaster context. Data were collected through a structured questionnaire using mostly closed-ended items measured on a five-point Likert scale, ranging from strong disagreement to strong agreement.

Independent and Dependent Variables

The article uses the thesis variables in a condensed form. The independent variables explain the factors that may influence public response, while the dependent variables represent the outcomes of communication effectiveness and protective behaviour.

Table 1: Variable type

Variable Type	Variable	Meaning in This Study
Independent variable	Communication exposure	Frequency and variety of disaster-related information received through social media, television, radio, mobile alerts, and community channels.
Independent variable	Trust and credibility	Respondents' confidence in government sources, media, social media, community leaders, and other information providers.
Independent variable	Cultural relevance	Whether messages are understandable, locally meaningful, language-appropriate, and suitable for community realities.
Independent variable	Perceived barriers	Practical and social obstacles that prevent action, such as unclear messages, delay, misinformation, transport problems, financial limitations, and language barriers.
Dependent variable	Protective behavior	Actions taken or intended by respondents, such as following safety instructions, seeking confirmation, preparing supplies, evacuating, or using shelters.
Dependent variable	Perceived communication effectiveness	Public evaluation of whether communication was clear, timely, credible, relevant, and useful for decision-making.

Table 2: Methodological aspect

Methodological Aspect	Summary
Research design	Quantitative cross-sectional survey.
Population	Adult residents of Pakistan who had exposure to disaster-related communication during 2025.
Sample	316 valid respondents were included in the final analysis.
Sampling technique	Non-probability convenience sampling due to time, access, and disaster-context constraints.
Instrument	Structured questionnaire covering demographics, communication exposure, trust, cultural relevance, barriers, protective behavior, and perceived effectiveness.
Data collection	Online and offline questionnaire distribution to improve reach.
Analysis	Descriptive statistics, item-level interpretation, correlation analysis, hypothesis testing, and regression-style interpretation.
Ethics	Voluntary participation, anonymity, informed consent, and academic use of data.

Findings

Demographic Profile

The final dataset included 316 valid responses. The demographic pattern showed that most respondents belonged to the 18-25 age group. Both male and female respondents were represented, with slightly higher female participation. Most respondents had undergraduate or postgraduate education, and a large proportion came from urban areas, although rural respondents were also included. Exact frequency values should be inserted from the raw SPSS or questionnaire output before final journal submission.

Questionnaire Focus and Important Questions

For article extraction, the most important questionnaire areas are those directly connected with the statistical analysis and the main research objectives. These areas justify the whole study because they measure the relationship between communication exposure, trust, barriers, and protective response.

Table 3: Questionnaire category

Questionnaire Category	Representative Important Question/Item	Reason for Inclusion
Demographics	Age, gender, education level, and area of residence.	These variables help explain whether perceptions differ across respondent groups.
Communication exposure	How frequently did you receive disaster-related information during 2025?	This item supports the analysis of whether exposure is associated with protective behavior.
Communication channel	Which sources did you rely on most, such as social media, television, radio, mobile alerts, or community sources?	This identifies the channels most relevant to public warning dissemination.
Trust and credibility	To what extent did you trust disaster information from government sources, media, social media, and community leaders?	Trust was one of the strongest factors related to protective behavior.
Cultural relevance	Were the messages understandable and suitable for your language and local context?	This item links message design with local acceptance and comprehension.
Barriers to action	Did unclear information, delay, conflicting messages, language problems, or limited resources prevent action?	This category explains why communication may not convert into immediate behavior.
Protective behavior	Did you follow safety instructions, seek more information from trusted sources, or take immediate protective steps?	This category measures the main behavioral outcome of risk communication.

Descriptive Findings

Overall, respondents rated environmental risk communication at a moderate level. Communication exposure had an approximate mean of 2.95, indicating that respondents received disaster information but not always consistently. Trust in information sources had an approximate mean of 3.16, also showing a moderate level of confidence. Perceived barriers had an approximate mean of 3.15, suggesting that respondents experienced meaningful obstacles in understanding or acting on warnings. Protective behavior had an approximate mean of 3.17, which indicates a moderate level of public response rather than a strong or immediate behavioral outcome.

Table 4: Descriptive statistics

Variable/Indicator	Approximate Result	Interpretation
Exposure to communication	Mean = 2.95	Moderate exposure; warning information reached respondents but not consistently.
Frequency of receiving disaster information	Mean = 2.57	Low-to-moderate frequency; indicates gaps in regular warning delivery.
Social media as information source	Mean = 3.46	High use; digital platforms were important for disaster updates.
Trust in information sources	Mean = 3.16	Moderate trust overall.
Government sources	Mean = 2.72	Lower trust compared with community and social sources.
Local community leaders	Mean = 3.40	Relatively strong trust; useful for last-mile communication.
Perceived barriers	Mean = 3.15	Moderate barriers, including delay, confusion, and unclear messages.
Immediate protective action	Mean = 2.94	Moderate but weaker than willingness, showing an action gap.
Seeking more information	Mean = 3.37	Respondents often tried to verify disaster information.
Overall protective behavior	Mean = 3.17	Moderate protective response.

Correlation and Hypothesis Findings

Correlation analysis showed moderate positive relationships among the major study variables. Exposure to disaster communication was positively associated with protective behavior, suggesting that people who received more information were more likely to respond. Trust had a stronger relationship with protective behavior than exposure alone, showing that credibility is essential in disaster communication. The positive association between barriers and behavior should be interpreted carefully. It may mean that respondents who were more engaged with disaster communication were also more aware of the constraints that limited action.

Table 5: Correlation

Relationship	Correlation	Interpretation
Exposure and protective behavior	$r = 0.40$	Moderate positive relationship; more exposure is linked with stronger protective behavior.
Trust and protective behavior	$r = 0.48$	Moderate positive relationship; trust is an important driver of public response.
Barriers and protective behavior	$r = 0.49$	Positive but complex; engaged respondents may recognize constraints more clearly.
Exposure and trust	$r = 0.45$	Moderate positive relationship; consistent exposure may support trust when messages are credible.

Table 6: Hypothesis testing

Hypothesis	Decision	Article-Level Interpretation
H1: Communication exposure positively affects protective behavior.	Supported	Exposure helps improve awareness and response, but it is not enough by itself.
H2: Trust significantly influences protective behavior.	Supported	Trust is a central factor in whether respondents accept and follow warnings.
H3: Perceived barriers reduce communication effectiveness.	Partially supported	Barriers matter, but their relationship is complex because highly engaged respondents may report more barriers.
H4: Cultural relevance improves perceived communication effectiveness.	Supported in interpretation	Messages delivered through familiar language and local sources are more likely to be accepted.
H5: Demographics influence perception and trust.	Partially supported	Patterns were observed, but exact comparative tests should be strengthened using full cross-tabulation or inferential analysis.

Discussion

The findings suggest that environmental risk communication in Pakistan during the 2025 disaster context was present but not strong enough to be considered highly effective. Moderate exposure indicates that respondents were receiving disaster-related information, particularly through social media, but communication was not always systematic or consistently available. This supports the argument that warning systems should not rely on a single channel. A stronger model would combine official alerts, social media updates, mobile messages, traditional media, and community-level announcements.

Trust emerged as one of the most important findings. The moderate relationship between trust and protective behaviour shows that public response depends not only on receiving a message but also on believing it. Lower trust in government sources compared with relatively stronger trust in local community leaders suggests that disaster agencies should work more closely with local figures such as religious leaders, elders, teachers, volunteers, and community organisations. Such actors can translate official warnings into familiar language and help verify the message locally.

The results also reveal an action gap. Respondents showed moderate-to-high willingness to follow safety instructions, yet immediate protective action was weaker. This means that people may agree with the advice but still delay action because of practical barriers. Unclear information, late warnings, conflicting messages, language limitations, financial constraints, transport problems, and uncertainty about safe shelter can all reduce the effect of communication. This finding supports the Situational Theory of Publics because constraints can prevent action even when problem recognition and involvement are present.

Cultural relevance was also important. Messages that are too technical, too general, or not adapted to local languages may fail to guide vulnerable groups. In Pakistan, where communities differ by language, literacy, gender roles, rural-urban location, and media access, the same message may not work equally for everyone. Framing Theory helps explain this issue because people respond better when messages clearly define the threat, explain who is at risk, and provide realistic steps for action. Disaster communication should therefore be framed around family safety, local risk, available support, and clear instructions rather than vague warnings.

Overall, the study indicates that effective environmental risk communication requires more than message dissemination. It requires credibility, repetition across channels, local adaptation, rumour

control, and practical support. The findings support a shift from a top-down information model toward a public-centred communication model in which authorities listen to communities, coordinate with local networks, and ensure that warnings are actionable for people with different levels of resources and access.

Conclusion

This article concludes that environmental risk communication in Pakistan during the 2025 natural disasters was moderately effective but remained constrained by inconsistency, trust issues, unclear or delayed messages, and practical barriers to action. Communication exposure and trust were positively associated with protective behaviour, while barriers indicated that awareness does not always lead to immediate action. Social media was a major source of information, but community leaders remained highly relevant for credibility and last-mile communication. To improve future disaster communication, authorities should design messages that are early, specific, locally understandable, culturally appropriate, verified, and linked with practical response options such as evacuation routes, shelters, transport, and emergency support.

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